

Inflammatory Bowel Disease Burden and Temporal Trends in China, 1990–2019: A Postprint Analysis

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Abstract

Background Inflammatory bowel disease (IBD) has exhibited a high incidence rate in recent years, characterized by a protracted course and heavy disease burden. However, current data on the disease burden of IBD in China are lacking, which may hinder healthcare planning and resource allocation for this disease. Objective To investigate the disease burden and changing trends of IBD in China from 1990 to 2019, and to analyze the effects of age, sex, and period on IBD. Methods Using the 2019 Global Burden of Disease database, data on IBD incidence rate, mortality rate, and disability-adjusted life years (DALY) rate in China from 1990 to 2019 were collected. Joinpoint software was used to analyze the trends and characteristics of standardized incidence rate, standardized mortality rate, and standardized DALY rate of IBD, and Excel 2019 software was used for data organization. Results From 1990 to 2019, the standardized incidence rate of IBD in China increased from 1.47/100,000 to 3.01/100,000, with an average annual percent change (AAPC) of 2.5% [95%CI (2.4, 2.6)], the standardized mortality rate decreased from 0.86/100,000 to 0.35/100,000, with an AAPC of -1.6% [95%CI (-3.8, -3.4)], and the standardized DALY rate decreased from 24.47/100,000 to 16.31/100,000, with an AAPC of -2.2% [95%CI (-2.3, -2.0)]. All trend changes were statistically significant ($P < 0.05$). In each year, the standardized incidence and mortality rates were higher in males than in females, while the standardized DALY rate was higher in females than in males before 1995, essentially the same between males and females from 1995 to 2001, and higher in males than in females after 2001. The AAPC of standardized IBD incidence rate across all age groups showed an overall steady upward trend in each year ($P < 0.05$); the AAPC of standardized mortality rate across all age groups showed an overall downward trend, but the decreasing trend slowed down with increasing age ($P < 0.05$). Conclusion From 1990 to 2019, the standardized mortality rate and standardized DALY rate of IBD in China showed

a downward trend, while the standardized incidence rate showed an upward trend. In each year, the standardized incidence and mortality rates were higher in males than in females. The disease burden of IBD in the elderly population warrants focused attention. Given China's large population base and population aging, the burden of IBD in China will be a major public health challenge.

Full Text

Disease Burden and Variation Tendency of Inflammatory Bowel Disease in China from 1990 to 2019

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Abstract

Background: In recent years, inflammatory bowel disease (IBD) has exhibited high incidence rates and is characterized by a prolonged disease course and heavy disease burden. However, current data on the burden of IBD in China are lacking, which may hinder healthcare planning and resource allocation for this disease.

Objective: To investigate the disease burden and variation tendency of IBD in China from 1990 to 2019, and to analyze the effects of age, sex, and time period on IBD.

Methods: Using the Global Burden of Disease Database 2019, we collected data on IBD incidence, mortality, and disability-adjusted life year (DALY) rates in China from 1990 to 2019. Joinpoint software was used to analyze variation trends and characteristics of standardized incidence, standardized mortality, and standardized DALY rates of IBD, and Excel 2019 was used for data processing.

Results: From 1990 to 2019, the standardized incidence of IBD in China increased from 1.47/100,000 to 3.01/100,000, with an average annual percent change (AAPC) of 2.5% [95%CI (2.4, 2.6)]. The standardized mortality decreased from 0.86/100,000 to 0.35/100,000, with an AAPC of -1.6% [95%CI (-3.8, -3.4)]. The standardized DALY rate decreased from 24.47/100,000 to 16.31/100,000, with an AAPC of -2.2% [95%CI (-2.3, -2.0)]. All trend changes were statistically significant ($P < 0.05$). The standardized incidence and mortality rates were higher in males than in females each year, while the standardized DALY rate was higher in females than in males before 1995, essentially the same between males and females from 1995 to 2001, and higher in males than in females after 2001. The AAPC of standardized IBD incidence showed an overall stable upward trend across all age groups by year ($P < 0.05$). The AAPC of standardized mortality showed an overall downward trend across all age groups, but the decreasing trend slowed with increasing age ($P < 0.05$).

Conclusion: From 1990 to 2019, the standardized mortality and standardized DALY rates of IBD in China showed decreasing trends, while the standardized incidence showed an increasing trend. The standardized incidence and mortality rates were higher in males than in females each year. The disease burden of IBD in the elderly population deserves focused attention. Given China's large population base and population aging, the burden of IBD in China will be a major public health challenge.

Keywords: Inflammatory bowel diseases; Burden of disease; Cost of illness; Variation tendency; Joinpoint model

Introduction

Inflammatory bowel disease (IBD) is an inflammatory condition primarily affecting the digestive tract, mainly comprising Crohn's disease (CD) and ulcerative colitis (UC), and represents a substantial global disease burden. It is estimated that over 1 million residents in the United States and approximately 2 million residents in Europe suffer from IBD [1-2]. IBD was previously more common in Western high-income countries and rarely reported in Asia, Africa, and Latin America [3]. However, at the turn of the 21st century, IBD has become a global disease with rising prevalence in newly industrialized countries in Asia, South America, and the Middle East [4]. In China, the incidence of IBD has increased with economic development and lifestyle changes, leading to a substantial increase in disease burden [5].

This study utilizes data from the Global Burden of Disease Study 2019 (GBD 2019) database to analyze variation trends in standardized incidence, mortality, and DALY rates of IBD in China from 1990 to 2019, providing a reference basis for IBD prevention and control in China.

1. Data and Methods

1.1 Data Sources IBD data were obtained from the GBD 2019 database. This database analyzed data from 1990 to 2019 across 204 countries for 369 diseases or injuries, including incidence, mortality, and disability-adjusted life year (DALY) rates by age, sex, and region [6]. This study extracted IBD data for China from 1990 to 2019 for descriptive analysis.

1.2 Statistical Analysis We described IBD incidence, mortality, and DALY rates by age and sex from 1990 to 2019. Age-standardized rates were calculated using the age structure of the GBD world standard population. We analyzed variation trends for each indicator and calculated change rates: change rate = (2019 value - 1990 value) / 1990 value \times 100%.

The log-linear model in Joinpoint regression was used to analyze age-standardized incidence, mortality, and DALY rate data for IBD. The annual percent change (APC) and average annual percent change (AAPC) were calculated for each indicator. The permutation test method was used to analyze the number of statistically significant joinpoints, their positions, and P-values. When APC or AAPC $>$ 0, it indicates an upward trend in that segment, and vice versa represents a downward trend. Joinpoint 4.9.1.0 software was used for data analysis with a test level of $\alpha = 0.05$ [7].

2. Results

2.1 Disease Burden of IBD in China from 1990 to 2019 From 1990 to 2019, the incidence of IBD in China increased from 1.45/100,000 to 3.62/100,000, representing an overall increase of 14.97%; the age-standardized incidence increased from 1.47/100,000 to 3.01/100,000, representing an overall increase of 10.48%. The mortality rate decreased from 0.47/100,000 to 0.33/100,000, representing an overall decrease of 29.79%; the age-standardized mortality rate decreased from 0.86/100,000 to 0.35/100,000, representing an overall decrease of 59.30%. The DALY rate decreased from 19.79/100,000 to 16.34/100,000, representing an overall decrease of 17.43%; the age-standardized DALY rate decreased from 24.47/100,000 to 16.31/100,000, representing an overall decrease of 33.35%. After 1995, the age-standardized incidence was lower than the crude rate, while from 1990 to 2009, the age-standardized mortality and age-standardized DALY rates were higher than the crude rates (Table 1, Figure 1 [Figure 1: see original paper]).

2.2 Disease Burden of IBD by Sex in China from 1990 to 2019

The standardized incidence in males increased from 1.72/100,000 in 1990 to 3.35/100,000 in 2019, an increase of 13%; standardized mortality decreased from 0.86/100,000 to 0.30/100,000, a decrease of 5%; standardized DALY rate decreased from 24.06/100,000 to 18.45/100,000, a decrease of 2%. In females, standardized incidence increased from 1.19/100,000 in 1990 to 3.24/100,000 in 2019; standardized mortality decreased from 0.84/100,000 to 0.30/100,000;

DALY rate decreased from 25.50/100,000 to 14.78/100,000. The standardized incidence and mortality rates were higher in males than in females each year, while the standardized DALY rate was higher in females than in males before 1995, essentially the same between males and females from 1995 to 2001, and higher in males than in females after 2001 (Table 1, Figure 2 [Figure 2: see original paper]).

Joinpoint regression analysis showed that for standardized IBD incidence in China from 1990 to 2019, the APC values were: 1.68% average annual increase from 1990-1995, 5.26% from 1995-2000, 1.31% from 2000-2005, 2.54% from 2005-2010, 1.73% from 2010-2015, and 2.55% from 2015-2019, with statistically significant trends ($P < 0.05$, Table 2).

For standardized IBD mortality, APC values showed: 1.72% average annual decrease from 1990-2004, 7.82% decrease from 2004-2007, 6.36% decrease from 2007-2013, 5.04% decrease from 2013-2016, and 1.13% decrease from 2016-2019, with statistically significant trends ($P < 0.05$, Table 3).

For standardized IBD DALY rates, APC values showed: 2.20% average annual decrease from 1990-1996, 0% change from 1996-2000, 1.95% decrease from 2000-2004, 4.47% decrease from 2004-2007, and 0.72% decrease from 2015-2019, with statistically significant trends ($P < 0.05$, Table 4).

Joinpoint regression analysis results showed that from 1990 to 2019, the AAPC for standardized incidence, mortality, and DALY rates of IBD in Chinese males were 2.3%, -3.1%, and -1.7% respectively, with statistically significant trends ($P < 0.05$). For females, the AAPC for standardized incidence, mortality, and DALY rates were 2.7%, -4.2%, and -2.7% respectively, with statistically significant trends ($P < 0.05$, Table 5).

2.3 Disease Burden of IBD by Age in China from 1990 to 2019 From 1990 to 2019, the AAPC of standardized IBD incidence across all age groups in China showed an overall stable upward trend, with statistically significant differences ($P < 0.05$, Table 6 , Figure 3 [Figure 3: see original paper]). In contrast, the AAPC of standardized mortality across age groups showed an overall downward trend, but the decreasing trend slowed with increasing age, with statistically significant differences ($P < 0.05$, Table 7). Excel area charts showed that standardized mortality and standardized DALY rates increased significantly with age.

3. Discussion

The burden of inflammatory diseases is rising globally, severely affecting patients' quality of life and work productivity, and attracting widespread attention from the medical community [8-9]. This study extracted epidemiological data on IBD patients in China from 1990 to 2019 from the GBD database, and analyzed the disease burden and variation tendency of IBD in China based on basic

indicators such as incidence, mortality, and DALY rates, providing a reference for clinical prevention and treatment of IBD.

This study shows that from 1990 to 2019, the incidence of IBD in China showed an upward trend, possibly related to rapid economic development and accelerated industrialization in developing countries. With China's rapid economic growth, lifestyle changes have occurred, and improvements in the healthcare system, widespread application of various diagnostic tools, and increasing awareness among patients and physicians have all contributed to improved IBD diagnosis rates, suggesting that environmental factors play an important role in IBD etiology [10-13]. The age-standardized mortality rate decreased from 1990 to 2019, reflecting improved survival among IBD patients, possibly due to increased use of immunomodulators, early introduction of biologics, improved surgical techniques, and enhanced awareness of colorectal cancer surveillance [14-15].

Regarding changes in IBD disease burden in China from 1990 to 2019, the launch of the New Rural Cooperative Medical Scheme in 2003 improved health status among low-income and impoverished populations [16]. However, given China's large population, the disease burden of IBD remains concerning.

This study's results indicate that increasing age is closely related to IBD disease burden. The observed incidence peak in China is currently concentrated in the 30-45 age group, with incidence varying across age groups and showing a decreasing trend with age. APC analysis shows that from 1990 to 2019, IBD mortality in China decreased relatively, but mortality risk increased with age, rising rapidly after age 60 and reaching the highest mortality rate among those over 80. Data projections indicate that by 2050, China will have 400 million residents aged 65 and older. With China's population aging, the high mortality rate among existing elderly IBD patients is a significant problem [17].

According to the 2019 Global Burden of Disease (GBD) results, female incidence was higher than male incidence from 1990 to 2019 [18]. In contrast, this study shows that the IBD burden in Chinese males is higher than in females, although studies published before GBD 2017 indicated that females had a greater IBD burden than males worldwide [17]. However, there is no clear explanation for the reasons behind sex differences in IBD incidence between Asian and Western countries. Some studies suggest that smoking may account for the male predominance in IBD incidence [19]. The Global Adult Tobacco Survey shows that smoking rates among Chinese males (52.9%) are far higher than among females (2.4%) [20].

In summary, although the burden of IBD in China has improved over the past 30 years, with clear decreasing trends in mortality and DALY rates, the incidence of IBD continues to rise annually. The burden of IBD in China remains heavy. IBD is more prevalent in males than in females. Given China's large population base and serious aging phenomenon, the disease burden among elderly IBD patients is a severe problem, suggesting that screening and diagnosis of elderly IBD patients

should be further strengthened. This study also has obvious limitations. The lack of reliable prevalence data is one of the main constraints in estimating the burden of IBD in China. Additionally, GBD does not distinguish between UC- and CD-related variables, making it impossible to compare their incidence, mortality, and DALY rates in the Chinese population. Therefore, this study only focused on trends in the overall burden of IBD.

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Author Contributions

Author contributions: Bao Yunli conceived and designed the study and drafted and revised the manuscript; Wang Zhe and Tang Hairu were responsible for literature and data collection and organization and drafted the manuscript; Li Na, Li Bin, and Ma Jun reviewed the article and participated in analysis and

discussion; Yu Xiaohui was responsible for final version revision and provided funding support.

Conflict of Interest

Conflict of interest: This article has no conflict of interest.

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